

Nuclide Mixtures

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Why mixtures ?

Mixture vs. simple nuclide → in the real life: mainly mixtures

Often-used module in other applications

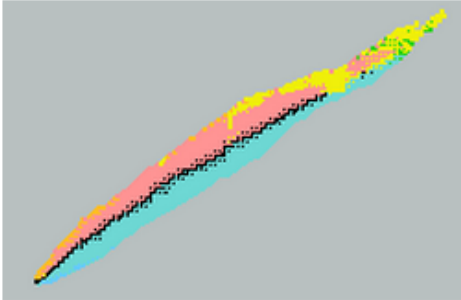
Go to Nuclide Mixtures Application...



... web driven nuclear science


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> Nuclide Explorer



» Actual Chart: Karlsruhe

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 Nuclear Data Retrieval



> Application Centre






- » Mass Activity Calculator, **New:** Mass Activity Converter
- » Decay Engine
- » Dosimetry & Shielding
- » Range & Stopping Power
- » In Silico Dosimetry
- » webKORIGEN
- » Decay Engine for Large Nuclide Sets
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- » Virtual Cloud Chamber
- » Geant4 Dosimetry
- » easy Monte Carlo
- » Cambio file Converter
- » WESPA
- » Gamma Library
- » webGraph

Welcome, Joseph





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Networking






> My Last Nuclides

-  27 Co60
-  55 Cs137
-  94 Pu239
-  92 U235
-  88 Ra226

> My Nuclide Mixtures

-  Natural Uranium
-  Fukushima II
-  Fukushima spectrum
-  Transuranics in 1 ton Spent Fuel
-  Fukushima

> My Sources


-  testco
-  Pu241 with daughters
-  Pu241 - 15mg - 8y old - solid, non-special form
-  Uranium metal
-  Uranium.xml
-  Pu239 1 g





My Mixtures


Nuclide mixtures in
bold are Sample
Mixtures

Other mixtures are
user created

To edit click on
mixture...


































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 **Nuclide Mixtures** [Getting started Reference manual](#)

My Mixtures Edit Upload Sample Mixtures

User defined nuclide mixtures

ID	Mixture	Date modified ▾	Download	Delete
	<i>(create, upload a new Mixture)</i>			
31545	Natural Uranium	08.06.2012, 10:23:37		
30747	Fukushima II	22.05.2012, 19:41:26		
30731	Fukushima spectrum	22.05.2012, 16:34:56		
30713	Fukushima spectrum	22.05.2012, 13:43:17		
29858	Cm 01	03.05.2012, 12:55:29		
28332	webKorigen nuclides 7	11.04.2012, 18:29:14		
27502	Cs137 / Ba137m	02.04.2012, 14:07:26		
27500	Ce-144 / Pr-144	02.04.2012, 14:06:27		
29403	Sr-90 / Y-90	29.03.2012, 14:50:42		
27344	Decay of 1.0e+006 Becquerel of Sr 90 / Y-90 after 0.02 Years(0)	29.03.2012, 14:49:09		
27339	Decay of 1.0000e+6 Becquerel of 38 Sr 90 after 0.1 Years(0.0)	29.03.2012, 14:18:24		
25607	Cs137 in equilibrium with Ba137m	11.03.2012, 11:59:42		
22651	Ucrit	19.01.2012, 09:53:48		
22650	waste	19.01.2012, 09:48:55		
15014	Reactor Grade Pu Sample	24.08.2011, 10:37:36		
12985	Korigen nuclides	14.06.2011, 13:20:10		
11818	Fukushima	13.05.2011, 14:21:59		
11663	HEU, highly enriched uranium	06.05.2011, 13:32:54		

Nuclide mixtures

Wiki page (Help)

Full technical documentation

h nucleonica

[wiki]

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Help:Nuclide mixtures

Level: Intermediate, Advanced

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1.1.1 Definition of a Virtual Nuclide for Radioactive Decay

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1.1.2.1 Input Numbers of Atoms

1.1.2.2 Input Masses

1.1.2.3 Input Activities

1.1.3 Half-Life of the Virtual Parent, t_V

1.1.4 Daughters of the Virtual Nuclide, P_1 , Q_1 , R_1

1.1.5 Branching Ratios, BR

1.1.6 Atomic Mass of the Virtual Nuclide, M_V

1.1.7 Conversion Half-Life of the Virtual Nuclide, $conT$

1.2 Application of Nuclide Mixtures to Dosimetry and Shielding

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1.4.1 Running Applications with Nuclides Mixtures

Nuclide Mixtures

In this chapter the formalism for calculations on mixtures of nuclides is developed. In particular the formalism for the radioactive decay of nuclide mixtures. A virtual parent is defined which decays on a time-scale required mixture. The procedure for obtaining the half-life, the daughters, the branching ratios,

Edit

Nuclide Mixture
example:
natural uranium



Nuclide Mixtures

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My MixturesEditUploadSample Mixtures

Name

Natural Uranium

Description:

1 mole natural uranium (U234, U235, U238) with isotopes fractions corresponding to the abundancies

Nuclide ▲	Activity(Bq)	Mass(g)	Number of Atoms	Mole	Activity ratio	Mass ratio	Mole ratio	Delete
(add a new Nuclide)								
92 U 234	2.997e+6	0.01264	3.252e+19	5.400e-5	0.4860	5.310e-5	5.400e-5	
92 U 235	1.354e+5	1.693	4.338e+21	7.204e-3	0.02264	7.114e-3	7.204e-3	
92 U 238	2.939e+6	236.3	5.978e+23	0.9927	0.4913	0.9928	0.9927	
Total: 3	5.981e+6	238.0	6.022e+23	1.000	1	1.000	1	

Significant figures: 4 ▼

Click on Total:... to rescale the mixture.

Element

Mass

Quantity

Unit

U ▼

238 ▼

236.3

Gram ▼

Update

Save Mixture

Reset

Cancel

Gram

Becquerel

Curie

Number of Atoms

Mole

Create

a new mixture:

 ... web driven nuclear science

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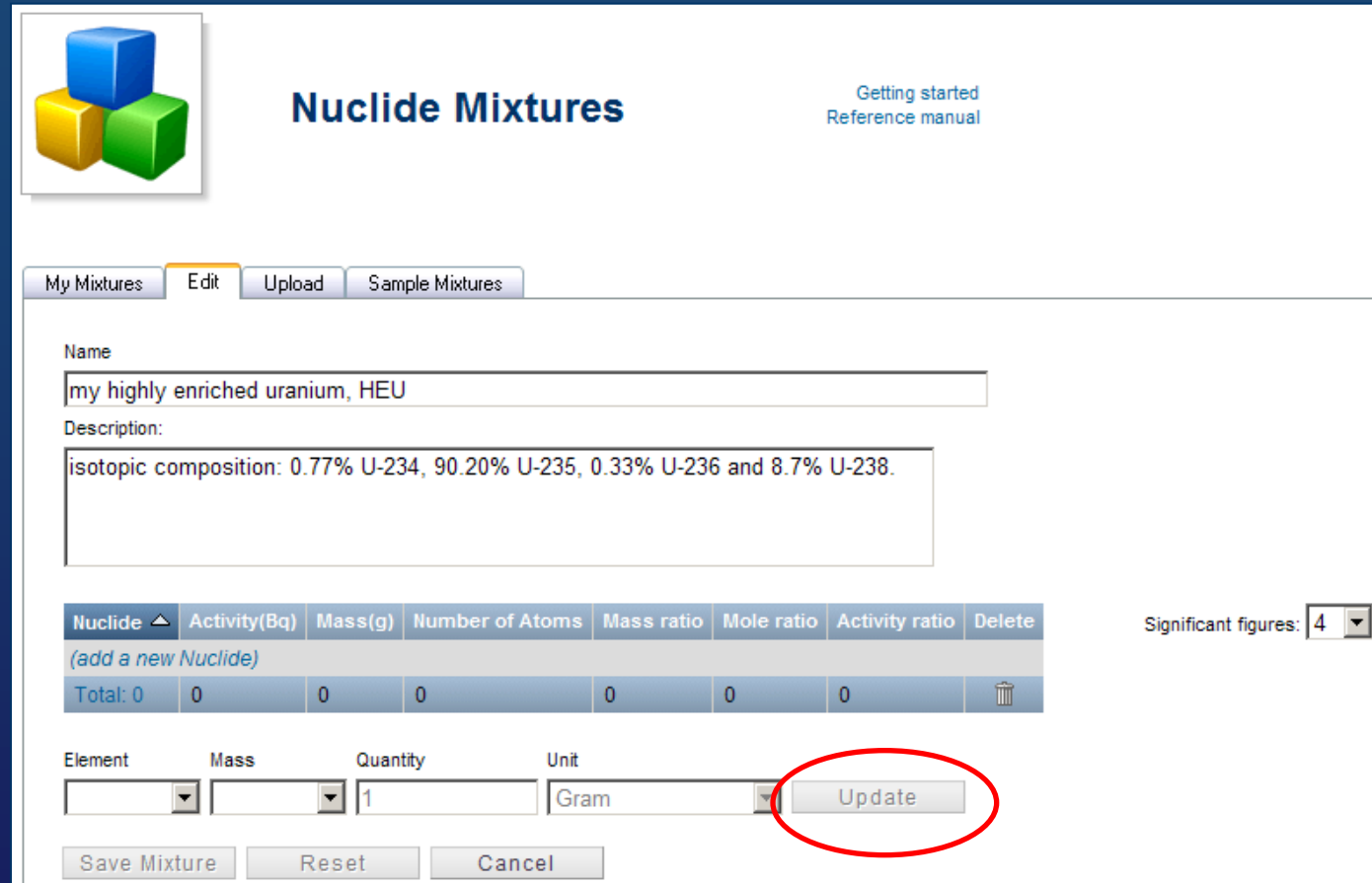
User defined nuclide mixtures

ID	Mixture	Date modified ▾	Download	Delete
	(create, upload a new Mixture)			
31545	Natural Uranium	08.06.2012, 10:23:37		
30747	Fukushima II	22.05.2012, 19:41:26		
30731	Fukushima spectrum	22.05.2012, 16:34:56		
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29858	Cm 01	03.05.2012, 12:55:29		
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27502	Cs137 / Ba137m	02.04.2012, 14:07:26		
27500	Ce-144 / Pr-144	02.04.2012, 14:06:27		
29403	Sr-90 / Y-90	29.03.2012, 14:50:42		
27344	Decay of 1.0e+006 Becquerel of Sr 90 / Y-90 after 0.02 Years(0)	29.03.2012, 14:49:09		
27339	Decay of 1.0000e+6 Becquerel of 38 Sr 90 after 0.1 Years(0.0)	29.03.2012, 14:18:24		
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11663	HEU, highly enriched uranium	06.05.2011, 13:32:54		

Create a new mixture:

Details

1. In Edit tab, enter a **name** for the mixture
2. Enter short description
3. Enter components → „(add a new nuclide)“
 - Choose a nuclide
 - Select a unit
 - Enter the quantity
 - Update grid
4. Save the mixture



The image shows the 'Nuclide Mixtures' application interface. At the top, there is a logo with three colored cubes (blue, yellow, green) and the title 'Nuclide Mixtures'. To the right of the title are links for 'Getting started' and 'Reference manual'. Below the title, there are four tabs: 'My Mixtures', 'Edit', 'Upload', and 'Sample Mixtures'. The 'Edit' tab is currently selected. In the 'Edit' tab, there are two text input fields: 'Name' (containing 'my highly enriched uranium, HEU') and 'Description' (containing 'isotopic composition: 0.77% U-234, 90.20% U-235, 0.33% U-236 and 8.7% U-238.'). Below these fields is a table with columns: 'Nuclide', 'Activity(Bq)', 'Mass(g)', 'Number of Atoms', 'Mass ratio', 'Mole ratio', 'Activity ratio', and 'Delete'. The table has a row for 'Total: 0' and a row for '(add a new Nuclide)'. To the right of the table is a 'Significant figures' dropdown menu set to '4'. At the bottom, there are four input fields: 'Element', 'Mass', 'Quantity' (set to '1'), and 'Unit' (set to 'Gram'). An 'Update' button is circled in red next to the 'Unit' field. Below these fields are three buttons: 'Save Mixture', 'Reset', and 'Cancel'.

Nuclide Mixtures

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Reference manual

My Mixtures Edit Upload Sample Mixtures

Name
my highly enriched uranium, HEU

Description:
isotopic composition: 0.77% U-234, 90.20% U-235, 0.33% U-236 and 8.7% U-238.

Nuclide ▲	Activity(Bq)	Mass(g)	Number of Atoms	Mass ratio	Mole ratio	Activity ratio	Delete
(add a new Nuclide)							
Total: 0	0	0	0	0	0	0	

Significant figures: 4 ▼

Element Mass Quantity Unit

Update

Save Mixture Reset Cancel

Create a new mixture:

Details

My Mixtures Edit Upload Sample Mixtures

Name

my highly enriched uranium, HEU

Description:

isotopic composition: 0.77% U-234, 90.20% U-235, 0.33% U-236 and 8.7% U-238.

Nuclide	Activity(Bq)	Mass(g)	Number of Atoms	Mass ratio	Mole ratio	Activity ratio	Delete
<i>(add a new Nuclide)</i>							
92 U 238	4.277e-17	3.439e-21	8.700	0.08802	0.087	5.940e-4	
92 U 236	3.058e-16	1.293e-22	0.33	3.310e-3	3.300e-3	4.248e-3	
92 U 235	2.815e-15	3.521e-20	90.20	0.9010	0.902	0.03910	
92 U 234	6.883e-14	2.992e-22	0.7700	7.659e-3	7.700e-3	0.9561	
Total: 4	7.200e-14	3.907e-20	100.0	1	1	1	

Significant figures:

Element

Mass

Quantity

Unit

Update

Save Mixture

Reset

Cancel



Nuclide Mixtures

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My Mixtures

Edit

Upload

Sample Mixtures

Name

HEU, highly enriched uranium

Description:

isotopic composition: 0.77% U-234, 90.20% U-235, 0.33% U-236 and 8.7% U-238.

Nuclide ▲	Activity(Bq)	Mass(g)	Number of Atoms	Mass ratio	Mole ratio	Activity ratio	Delete
(add a new Nuclide)							
92 U 234	6.88347e-14	2.99248e-22	0.770000	7.65876e-3	0.0077	0.956060	
92 U 235	2.81501e-15	3.52050e-20	90.2000	0.901014	0.902000	0.0390983	
92 U 236	3.05835e-16	1.29348e-22	0.330000	3.31044e-3	3.30000e-3	4.24781e-3	
92 U 238	4.27690e-17	3.43905e-21	8.70000	0.0880167	0.087	5.94028e-4	
Total: 4	7.19983e-14	3.90727e-20	100.000	1.00000	1.00000	1	

Element

Mass

Quantity

Unit

1e3

Gram

Update

Save Mixture

Reset

Cancel

Gram
Gram
Becquerel
Curie
Number of Atoms
Mole

Save as Sample


Rescale feature...

Rescale results

for example

from 100 atoms to 1 kg!

Sample Mixtures: Pre-defined Mixtures



Nuclide Mixtures

My Mixtures Edit Upload Sample Mixtures

Select	Sample Mixture Name	Date Modified	Delete
<input checked="" type="checkbox"/>	Ce-144 / Pr-144	02.04.2012, 14:06:35	
<input checked="" type="checkbox"/>	Cs137 / Ba137m	02.04.2012, 14:07:29	
<input checked="" type="checkbox"/>	Fukushima spectrum	22.05.2012, 16:35:01	
<input checked="" type="checkbox"/>	HEU, highly enriched uranium	06.05.2011, 13:32:54	
<input checked="" type="checkbox"/>	I131_Cs137_mixture	14.03.2011, 16:22:45	
<input checked="" type="checkbox"/>	Natural Thorium	10.03.2010, 13:36:26	
<input checked="" type="checkbox"/>	Natural Uranium	08.04.2010, 15:50:06	
<input checked="" type="checkbox"/>	Rb-81/Kr-81m Generator	06.01.2011, 17:03:59	
<input checked="" type="checkbox"/>	Reactor Grade Pu Sample	10.05.2011, 13:33:12	
<input checked="" type="checkbox"/>	Sr-90 / Y-90	29.03.2012, 14:51:09	
<input checked="" type="checkbox"/>	Transuranics in 1 ton Spent Fuel	10.03.2010, 14:31:18	
<input checked="" type="checkbox"/>	U232+Co60	10.03.2010, 13:50:08	

Send to My Mixtures

Create a new mixture: Save & Download mixture

My Mixtures | **Edit** | Upload | Sample Mixtures

Name: my highly enriched uranium, HEU

Description: isotopic composition: 0.77% U-234, 90.20% U-235, ...

Nuclide	Activity(Bq)	Mass(g)	Number of Atoms
92 U 234	1.762e+6	7.659e-3	1.971e+19
92 U 235	7.205e+4	0.9010	2.309e+21
92 U 236	7.827e+3	3.310e-3	8.446e+18
92 U 238	1.095e+3	0.08802	2.227e+20
Total: 4	1.843e+6	1	2.559e+21

Element: [] Mass: [] Quantity: 1 Unit: Gra

Save Mixture | Reset | Cancel

My Mixtures | Edit | Upload | Sample Mixtures

User defined nuclide mixtures

Mixture	Date modified	Download	Delete
(create, upload a new Mixture)			
my highly enriched uranium, HEU	06.05.2011, 14:13:37		
HEU, highly enriched uranium	06.05.2011, 13:32:54		
My Uranium			
My U232+Co60 Mixture			
Natural Uranium			
Decay of 1 Grams of 3			
U232+Co60			
Transuranics in 1 ton			
Natural Thorium			
Cs137 + Ba137m			
All Mixtures (10)			

File Download

Save in: Mixtures

Save As: Mixture_my highly enriched uranium, HEU.xml

File name: Mixture_my highly enriched uranium, HEU.xml

Save as type: XML Document

Save | Cancel

Creating and Using Nuclide Mixtures in Nucleonica

Exercise:

1. Create a nuclide mixture containing 100 atoms for natural uranium with the following composition:

U-238: 99.2742 atoms,

U-235: 0.7204 atoms,

U-234: 0.0054 atoms

2. Rescale the results to 1 kg (click on "Total" in the grid to rescale the results)
3. Create a new mixture containing 100 g of 20% enriched uranium using:
U-238 = 80 g, U-235 = 20 g, (neglect U-234)
4. Rescale the results to 8.5 g enriched uranium (click on "Total" in the grid to rescale the results)